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ENVIRONMENTALLY FRIENDLY NUTRIENT SUPPLY OF MAIZE

PÉTER JAKAB[1], PIROSKA NAGY[2], ISTVÁN KRISTÓ[3]

[1] University of Szeged, Faculty of Agriculture
Institute of Plant Sciences and Environmental Protection
Andrássy út 15, 6800 Hódmezővásárhely, Hungary
[2] College of Szolnok, Department of Technical and Agricultural Management
Tiszaligeti sétány 14, 5000 Szolnok, Hungary
[3] Hungarian Chamber of Agriculture, Food and Rural Developement, Csongrad County Directorate
Kossuth L. sgt. 17, 6722 Szeged, Hungary
jakabpeter@mgk.u-szeged.hu

ABSTRACT
We examined the effect of foliar fertilization on the yield of maize hybrids in 2013. The experiment was set in three repetitions, random blocks on an ecological farm. The soil of the experiment was chernozem. Soil analysis data showed that it had proper nitrogen, plenty phosphor and very good potassium content. During the experiment we applied two times foliar fertilization in 5-5 l/ha dosage. The year 2013 was unfavourable for maize production. In 2013 the amount of precipitation in the graining phase of maize was lower by 59 mm than the average. The yield of the control plots ranged between 9.9-11.8 t/ha, the yields of the foliar fertilization plots ranged between 10.3-11.47 t/ha. There were not significant differences between the average yields of control and foliar fertilization plots. By the application of foliar fertilization the yield fluctuation decreased. Factual conclusion can be drawn only after the results of several years, we wish to continue our examinations.

Keywords: maize, nutrient supply, yield, foliar fertilization,

INTRODUCTION

Nutrient supply is one of the most important agrotechnical elements of maize production. Numerous researchers have been involved in determining the optimum NPK fertilizer doses for the different maize hybrids.

Considering the aspects of efficiency and environment protection, maize needs only N_{60-120}, $P_2O_{5\ 45-90}$, K_2O_{53-106} kg ha^{-1} active agent. With N doses larger than N_{60-120} kg ha^{-1} the quantity of NO_3-N reaches 150-200 mg kg^{-1} in the 100-120 cm soil profile which can result in marked environment pollution (SÁRVÁRI, 1995).

In the N_0 treatment, the yield decreased gradually and the cumulated yield difference was 74.0 t ha^{-1} as compared to the basis treatment (N_{80}). In the average of 1970-1991, the grain yield of maize (t ha^{-1}) was the following as per N-treatments: N_0: 3.56, N_{80}: 6.93, N_{160}: 8.12 and N_{240}: 8.00. In the N_{160} treatment the yield surpassed that of N_{240} treatment after the 13th year of the trial, and the cumulated extra yield was 26.3 t ha^{-1} in comparison with the basis treatment. In wet years, the grain yield of maize was higher depending on the N-treatment by 1.13-2.28 t ha^{-1} than in the dry years (BERZSENYI, 1993).

DOBOS AND NAGY (1998) examined the effect of year and fertilisation on the dry matter production of the maize hybrid Volga SC on a 5-year series of data in four replications, including two favourable and three unfavourable years, without fertilisation and with a fertiliser treatment involving 120 kg ha^{-1} N+ 90 kg ha^{-1} P_2O_5 + 106 kg ha^{-1} K_2O.

In the unfertilised treatment there was a significant difference in the dry matter content of the maximum vegetative mass in the years examined. In the fertilised treatment higher values were recorded each year than in the control plots, the fertiliser effect being 17-19 % in 1991, 1993 and 1994 and 22-28 % in 1992 and 1995.

NAGY (1995) determined the profitable fertilizer rate in production practice, based on the experimental data, the fertilizer active agent quantities belonging to 10 kg grain yield were fixed, and these values can be converted to different economic circumstances, as well. The fertilizer rate belonging to 10 kg marginal efficiency in the non-irrigated treatment, during four years, was 111 kg ha^{-1} N (its extreme values being 89-125 kg). In the irrigated treatment, on average a rate of 158 kg ha^{-1} N met the condition of 10 kg marginal efficiency, which varied between 147 kg and 170 kg. It was stated, that based on the experimental data - on similar production site - without irrigation a rate of 90-120 kg ha^{-1} N and in irrigated production a rate of 150-170 kg ha^{-1} N may be a normal dose.

PEPÓ (2001) found that crop rotation strongly modified the optimum N doses (+PK) of maize. The optimum N doses were N_{113}+PK in triculture, N_{147}+PK in biculture and N_{187}+PK in monoculture. The efficiency of fertilization was modified by crop rotation and the water supply of the crop year. The yield surpluses resulting from fertilization were 1378 kg ha^{-1} in triculture (peas-winter wheat-maize), 2477 kg ha^{-1} in biculture (winter wheat-maize) and 2325 kg ha^{-1} in monoculture. There were hybrid-specific differences between the maize genotypes in optimum N doses (+PK) in the long-term experiments (in triculture N-opt+PK 60-180 kg ha^{-1}, in biculture N-opt+PK 120-180 kg ha^{-1}, in monoculture N-opt+PK 120-240 kg ha^{-1} depending on genotypes). In practice, the best hibrids are those that can produce high yields with the application of moderate (low) N doses (+PK).

KÁDÁR (2008) says that the macro and micro element requirements of most arable crops can be satisfied through soil. The future spread of foliar fertilisation must be grounded by comprehensive experimental research. Accurate, repeated small plot trials are necessary to clarify the factors influencing the effectiveness of foliar fertilizers and recommendations must be developed for consultation.

MATERIAL AND METHOD

Soil properties of the experimental field

We set the experiment on the area of an ecological farm in Kútvölgy. The soil was chernozem, the reaction of which was nearly neutral (pH_{KCL} 6.86). Before setting the experiment the soil analysis data showed that it had proper nitrogen, plenty phosphor and very good potassium contents (*Table 1*).

Table 1. Main properties of the experimental field area

pH (H_2O)	P_2O_5 (mg/kg)	K_2O (mg/kg)	Humus (%)	Soil plasticity value (K_A)
6.86	604	653	2.8	42

Weather in the experimental years

The year 2013 was unfavourable for maize production. In 2013 the amount of precipitation in the graining phase of maize (July and August) was lower by 59 mm than the average. Totally, we can say that low precipitation had a negative effect on the development of maize (*Table 2*).

Table 2. The distribution of precipitation in the vegetative period of maize in 2013

Month	Rainfall (mm)	Average rainfall (mm)	Difference (mm)
April	41	42	-1
May	91	47	+44
June	79	72	+7
July	11	60	-49
August	44	54	-10
September	42	32	+10
Total amount of rainfall (mm)	**308**	**307**	**+1**

Main features of the agro-technology applied

Our small-scaled plough experiment was set in three replications, organised as a random block in 2013. We applied foliar fertilization treatments, which we supplemented with a control plot. The amount of nitrogen was applied in autumn and spring in 50-50%; the total amount of phosphorus and potassium was applied in autumn in one dosage. The foliar fertilization was applied twice (15 of May, 6 of June) in a dosage of 5-5 l/ha. The fore-crop was winter wheat. Fall tillage involved deep ploughing at 32 cm depth in the experimental years. The maize hybrid in the experiment was Finkass. We processed the obtained data by single factor variant analysis (SVÁB, 1981).

RESULTS

Without foliar fertilization the yield of the examined hybrid was ranging between 9.9-11.8 t/ha. In control plots the yield fluctuation was 1.9 t/ha. With foliar fertilization the yield was 10.3-11.47 t/ha. Under the influence of foliar fertilization treatments the yield fluctuation was lower 1.17 t/ha (*Table 2*).

Table 2. The effect of foliar fertilization on the yield of maize hybrid (t/ha)

	1. repl.	2. repl.	3. repl.	yield (average repl.)	yield fluctuation
control	11.80	11.07	9.9	10.92	1.90
foliar fertilization	11.47	10.45	10.3	10.74	1.17

The yield of the control plots/treatments in the average of three replications was 10.92 t/ha. Under the influence of foliar fertilization the yield was 10.74 t/ha. There is no significant difference between the yields (*Figure 1*). The foliar fertilization does not decrease the yield of maize. It is necessary to continue the experiment to explore the exact reasons because the results of at least three years are needed to draw the correct conclusions about the continuation of the experiment.

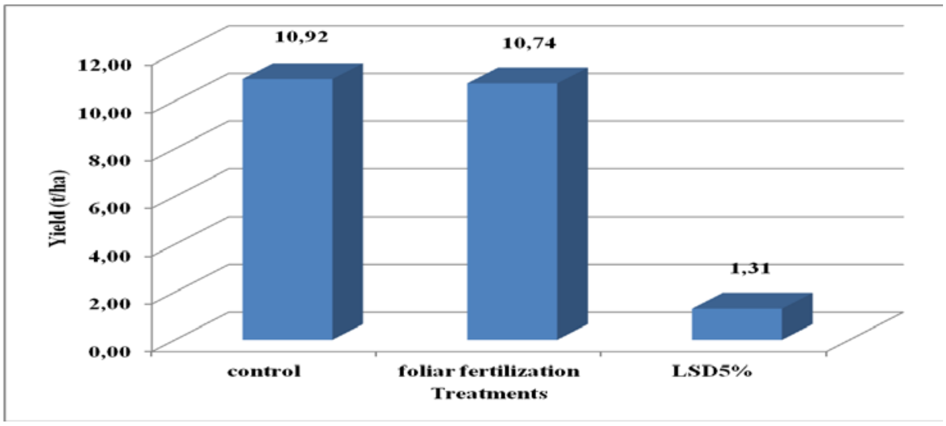

Figure 1. The yield of the maize hybrid in control and foliar fertilization treatment

CONCLUSIONS

The foliar fertilisation of corn is currently not part of the production technology. As KÁDÁR (2008) emphasized, the future spread of foliar fertilization should be grounded by a comprehensive experimental research. Accurate, repeat small plot trials are necessary to clarify the factors influencing the effectiveness of foliar fertilizers and to develop proposals for consultancy. The present experiment and its continuation also serve this purpose.

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